Space Weather Technical Forecast

Issued on Saturday, 23 October 2021 at 13:27 Local

This technical forecast provides a four day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

Space Weather Forecast Headline: Slight chance of Moderate class flares. Otherwise no significant activity expected.

Analysis of Space Weather Activity over past 24 hours

Solar Activity: Solar activity was Very Low, with only minor B-Class flares. A large sunspot region, AR2887, rotated onto the visible disk and appears to have an Eko/Beta-gamma configuration. Another numbered region is AR2886 in the southeast quadrant approaching the meridian, remains a moderately sized single spot with a magnetically simple configuration, carrying an Hsx/Alpha configuration. There are also two new small and simple unnumbered regions in the eastern disk. One in the north is a Axx/Alpha, and one in the south is a Bxo/Beta. There were no Earth Directed CME's visible in available coronagraph imagery.

Solar Wind / Geomagnetic Activity: Solar wind speeds, as measured by DSCOVR at L1, have been on a steady but erratic decline from near 500 km/s to 390 km/s throughout the 24 hour period. The solar wind density was largely average initially then became generally below average by 22/2000UTC. Total IMF, Bt, was weak, as was the north-south Bz component, which was mainly positive. The Phi angle was mainly negative (towards the Sun). Resultant geomagnetic activity was Quiet (Kp 0-2).

Energetic Particles / Solar Radiation: The high energy proton flux (greater than 10 MeV) as measured by GOES-16 was at background levels, with no solar radiation storms observed. High energy electron flux (greater than 2 MeV) was predominantly at background levels. Associated 24-hour electron fluence was well below the Active (1e8 integrated pfu) threshold, with 1.51e6 integrated pfu recorded at 23/0000 UTC.

Four-Day Space Weather Forecast Summary

Solar Activity: Solar activity is expected to be at Low or Very low levels, but with a slight chance of M-class flares (20%). The elevated probabilities result from a large sunspot region close to the southeast limb and also a number of other groups expected to rotate onto the Earth-facing disc in the coming days.

Solar Wind / Geomagnetic Activity: The solar wind is expected to remain at slow-ambient or slightly elevated levels in the coming days. No new high speed streams are expected during the period. Geomagnetic activity is very likely to be Quiet through the next four days (Kp 0-2).

Energetic Particles / Solar Radiation: The high energy (greater than 10 MeV) proton flux is expected to remain at background levels, with no solar radiation storms currently expected. The high energy electron flux (greater than 2MeV) is likely to remain at or near background levels, with the 24-hour fluence corresponding to low values throughout (remaining below the Active 1e8 integrated pfu threshold).

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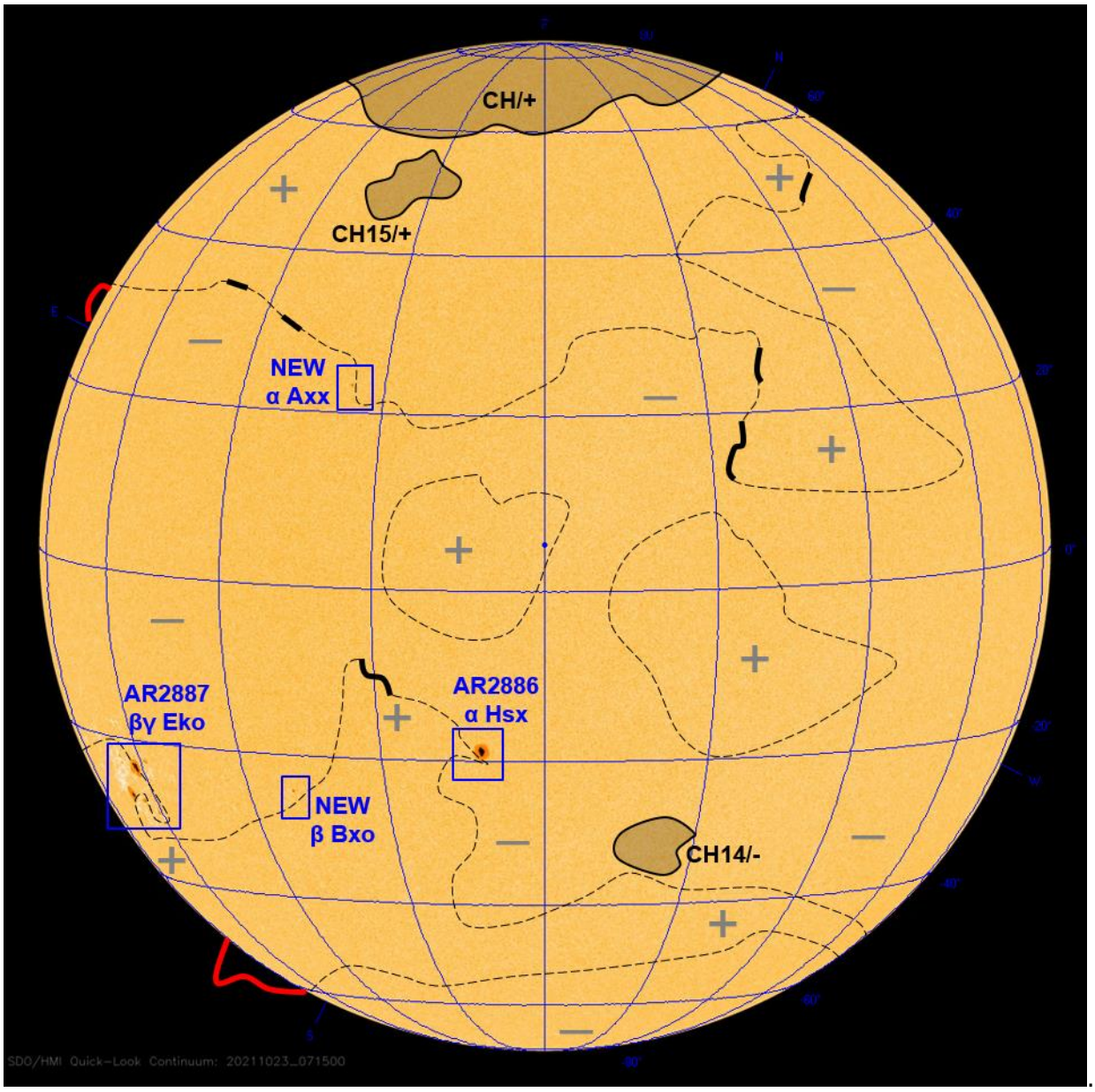
Figure 1. Solar Analysis Valid 23/0800 UTC.



Key: Filament ___ , Prominence ___ , Magnetic Field Line - - - , Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α-β-βγ-βγδ and Zurich-McIntosh Axx etc.

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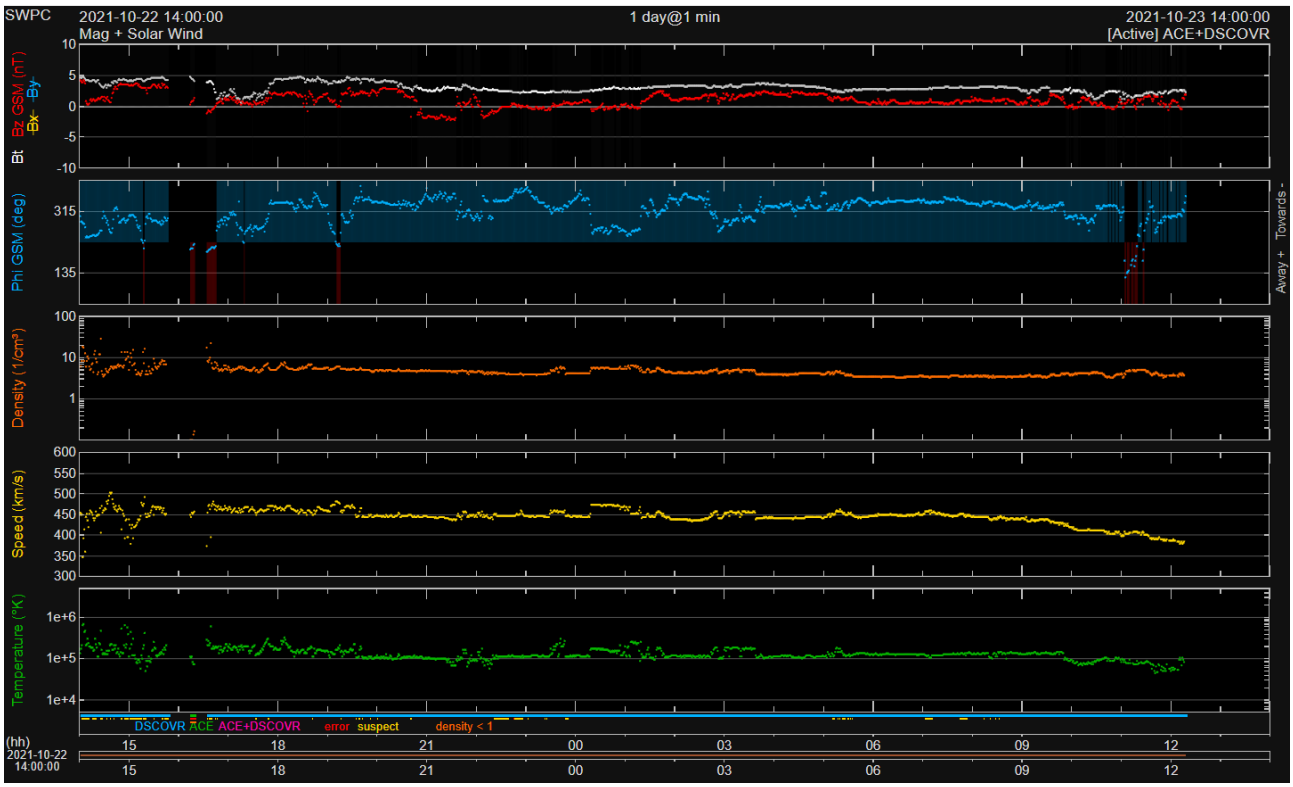
Geomagnetic Storms:

Solar winds are currently at slow-ambient levels and continue to decline. No Earth-directed CMEs currently feature in the period.

In the absence of any high speed stream influences over the coming days the solar wind is very likely to reach background levels and stay at ambient speeds through the rest of the period. Geomagnetic activity is currently expected to be Quiet (Kp 0-2).

Geo-Magnetic Storm Probability (Exceedance)	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Minor or Moderate	G1 to G2	No	1	1	1	2
Strong	G3	No	1	1	1	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

Figure 2: SWPC Real Tie Solar Wind Parameters.



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Radio Blackouts - X-Ray Flares:

Solar activity is expected to be at Low or Very Low levels through the period, but with a slight chance of Moderate activity.

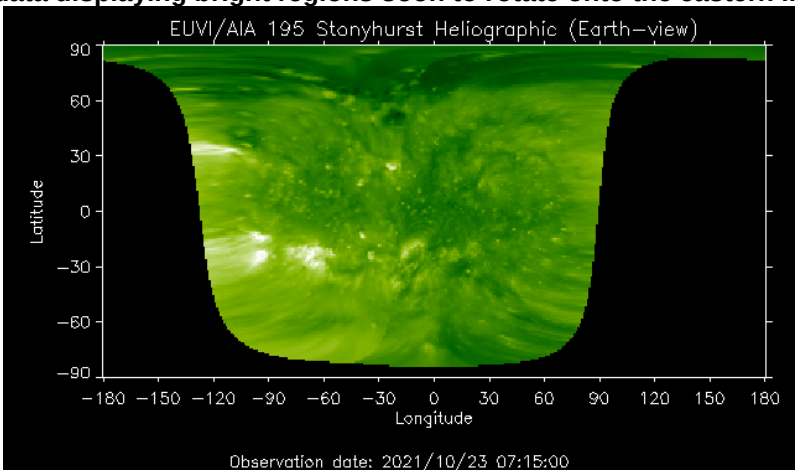
There are two numbered active region on the visible disc at present. AR2886 (Hsx/Alpha), located in the southeast quadrant close to the meridian remains in a stable configuration with no notable flares observed during the past 24 hours. The region near the southeast limb, numbered AR2887, shows multiple sunspots. The two largest spots in the group, of opposite polarity, contain large asymmetric penumbra. There are few, if any spots between the leader and follower portions of the group. The classification of Eko/Beta-gamma remains for this region, though assessment will be easier once it has moved into better view as there remains a foreshortening effect on this area at present. There are also two simple spots in the eastern disk, neither currently notable at present.

A number of bright flux regions are evident close to the eastern limb STEREO EUVI 195 imagery in both the north and southern hemispheres. These regions are expected to rotate onto the earth-facing disc in the coming days and may present an increased risk of significant flaring.

The elevated probabilities of M-class flares represents the risk from AR2887 and the new regions soon to rotate onto the earth-facing disc in the coming days.

X Ray Flares	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability			(%)	(%)	(%)	(%)
Active	R1-R2 M Class	No	20	20	20	20
Very Active	R3 to R5 X Class	No	1	1	1	1

Figure 3: Stereo A data displaying bright regions soon to rotate onto the eastern limb.



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Solar Radiation Storms - (High Energy Protons):

With no significant sunspots in geoeffective positions on the Sun, solar radiation storms are currently not expected.

Radiation Storms Probability (Exceedance)	Level (cm^{-2} sr^{-1} s^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ S1**	No	1	1	1	1
Very Active	**≥ S3 ***	No	1	1	1	1

* S3 ≥ 10 MeV ≥ 1000 pfu and / or ≥ 50 MeV ≥ 10 pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)

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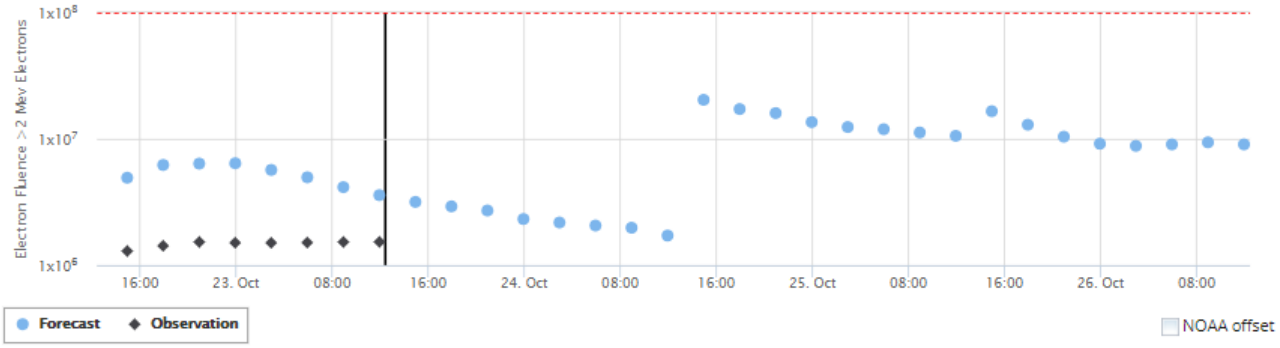
High Energy Electrons Event (≥ 2MeV):

The high energy (greater than 2 MeV) electron flux is currently at very low background levels. The influence of the current high speed stream, from CH13/-, has not been sufficient enough to raise electron flux counts within the radiation belts, probably due to the wrong phi-angle polarity for the time of year (negative is less efficient at disrupting our magnetosphere in the Boreal Autumn). Flux levels rose on the previous rotation, but not above the High (1000 pfu) level, and perhaps there was some preconditioning going on which isn't evident now.

The corresponding electron fluence is currently well below the Active (1e8 integrated pfu) threshold on a steady trend. The REFM model is currently indicating a rising trend in electron fluence over the coming days, probably in response to persistence from the previous rotation. As discussed this is likely overdone and expected to remain well below the threshold through the period.

GEO Electron Environment Probability (Exceedance)	Level (cm^{-2} sr^{-1} day^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ 2 MeV ≥ $1x10^8$**	No	1	5	5	1
Very Active	**≥ 2 MeV ≥ $1x10^9$**	No	1	1	1	1

Figure 4: REFM Oberved and forecast fluence.



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